

Teleology and Teleonomy in Behavior Analysis

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Teleological descriptions and explanations refer to purpose as consequent to a phenomenon. They become nonteleological if purpose is represented as antecedent to the phenomenon. Such nonteleological statements are called *teleonomic*, especially when they refer to antecedent genetic "programs." In behavior analysis, purpose is attributed to the organism's history of consequences. Such a history may leave a trace—physiological (mechanism) or mental (cognitivism)—or the issue of traces may be irrelevant (contextualism). The history or trace is antecedent to current responding, and thus is not a teleological concept in the classical sense. It could be called a teleonomic concept, but this designation is undesirable if it implies exclusively genetic programming, because the history or trace is genetically programmed in evolutionary selection but not in ontogenetic selection. Therefore, the concepts of teleology and teleonomy are not useful for behavior analysis, and invoking them can be misleading. The concept of purpose can be useful if it is not reified.

Key words: behavior analysis, philosophical analysis, purpose, teleology, teleonomy

Although the issue of purpose, or teleology, has a history dating back at least to Aristotle, it is still debated in philosophy and in science. One approach has been to reject teleology in favor of *teleonomy* (e.g., Imam, 1989, 1992; Monod, 1972), but the concept of teleonomy is problematic in some ways (e.g., Moxley, 1991). Skinner (e.g., 1974, p. 224) attributed purpose to the history of consequences, but this approach also has some problems. The purpose of this paper is to explore the meanings of teleology, teleonomy, and purpose, specifically with respect to applications of these concepts in behavior analysis. The conclusions reached are that the concepts of teleology and teleonomy can and should be dispensed with in behavior analysis because their applications create more problems than they solve, but that the concept of purpose can be useful, especially in conceptual analyses, provided that it is clearly identified as a derived concept and consequently is not reified.

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TELEOLOGY

The word *teleology* has been used in many senses, but all refer to descriptions or explanations of phenomena in terms of final causes, that is, ends, goals, purposes, or *teloi* (e.g., Nagel, 1979). For stylistic convenience, I use the word *purpose* hereafter to denote all these final causes, except when this word does not convey quite the intended meaning. As will be seen, different senses of teleology differ with respect to the meaning of purpose.

Purposiveness and Purposefulness

A preliminary point is that much, and perhaps all, of the modern confusion about the meanings of teleology disappears when a distinction is made between the adjectives *purposive* and *purposeful*. Although these adjectives are often used as synonyms, the first meanings in *Webster's New Collegiate Dictionary* (1977) are fundamentally different: *Purposive* means "serving or effecting a useful function though not as a result of planning or design"; *purposeful* means "full of determination" (p. 937). Thus, *purposive* means *serving* a purpose, and *purposeful* means *having* a purpose; *purposive* means attaining some end or goal, and *purposeful* means having some end or goal.

Behavior can be *purposive* without being *purposeful* and *purposeful* without

being purposive. Thus, adaptive behavior is necessarily purposive but not necessarily purposeful; deliberate behavior is necessarily purposeful but not necessarily purposive—it is not necessarily adaptive, it does not necessarily attain any purpose. Operant behavior is purposive; it serves a purpose in the sense that it is followed by a particular outcome. Nothing is gained by invoking mental purposes that would be needed to justify calling operant behavior purposeful. This was Skinner's point in saying, "Operant theory moved the purpose which seemed to be displayed by human action from antecedent intention or plan to subsequent selection by contingencies of reinforcement" (1974, p. 224); more briefly, the purpose of an act is simply its characteristic consequences (Skinner, 1961, 1963, 1966, p. 245). Skinner (1963) recognized what he called "the specter of teleology" (p. 503) in this principle, and he rejected this specter.

Grand-Design Teleology

Definition. A dictionary (Webster's, 1977) definition of teleology is:

1 a: the study of evidences of design in nature b: a doctrine (as in vitalism) that ends are immanent in nature 2: the fact or character attributed to nature or natural processes of being directed toward an end or shaped by a purpose 3: the use of design or purpose as an explanation of natural phenomena. (p. 1198)

These meanings of teleology have in common (a) the concept of purpose as *final cause*, which requires reversal of time (the future determines the present) and (b) the location of purpose *in nature*. This is the classical sense of teleology (Mayr, 1982, pp. 47–48, 50–51) and the sense that mechanistic theologians used (Moxley, 1991). As used by these theologians, teleology reflects a mechanistic model in which the maker of the machine is interpreted as "positive analogy," in Hesse's (1966) terminology. Hesse noted that a model of any domain is an analogical representation of the modeled domain, and that some parts of the model may not be represented in the modeled domain. *Positive analogy* is the part of the

model that is explicitly linked to the modeled domain; *neutral analogy* is the part of the model that has no known link and that can therefore be ignored; and *negative analogy* is the part that must not be linked to the modeled domain, on pain of confusion. For example, in a computer model of problem solving, the program is positive analogy, the monitor screen is probably neutral analogy, and the programmer is negative analogy.

An important implication of Hesse's analysis is that a model is *only* a representation, and taking the model to be the modeled domain would be a kind of "category-mistake" (Ryle, 1949, chap. 1) or "levels of analysis error" (Overton, 1993). Pascual-Leone cited a Buddhist saying that makes the same point: "As soon as one thinks that the finger is the moon itself, one no longer wants to look in the direction the finger is pointing" (Pascual-Leone, 1991, second epigraph, p. 302). The finger that points to the moon is analogous to a model of the moon, and one must not be so taken with the model that one no longer looks at the moon itself (p. 327).

Theological versions. The classical sense of teleology has traditionally been used by mechanistic theologians, as Moxley (1991) noted. He cited George S. Morris (1875), but Morris was an idealist (he was an Hegelian) rather than a mechanist. A better, and older, example of a mechanistic theologian is Edward Reynolds (1656), who believed that God created the universe so that it operates mechanically. This sense was also held by some mechanistic scientists; for example, Isaac Newton believed that God fulfills His purpose by periodically correcting inaccuracies in the working of the universal machine, but the prevailing view among mechanistic scientists was that God created the machine and the laws governing its operation, and then started it and let it run independently (Barbour, 1966, chap. 2).

The classical sense of teleology was also used by idealist theologians such as Thomas Aquinas (1268/1922, p. 176), Jonathan Edwards (1754/1957), and, as already noted, George S. Morris (1875).

They have in common with the mechanistic theologians the attribution of purpose to God's grand design: The universe and its constituents move the way they do because they are fulfilling this grand design. However, the idealist theologians believed that God not only created the universe but also personally guides its operations. Morris acknowledged that mechanistic laws are descriptively accurate, but he believed that they are descriptively accurate because God chose to guide the universe in a way that makes them descriptively accurate. That is, the operation of the universe is caused by God's will but is descriptively consistent with mechanistic laws that scientists infer.

Finally, this kind of teleology was evidently held by some creationists, but without necessarily specifying who or what was the source of the grand design (for brief discussion, see Baum & Heath, 1992).

Nontheological versions. Although the grand-design sense of teleology was often associated with theology, it also appeared in nontheological philosophies, including Aristotle's, Leibniz's, and Hegel's. In Aristotle's philosophy, which is consistent with mechanism, nature is reasonable and, whenever possible, arranges for the best location of an organ or process (*On the Parts of Animals*, book 3, chap. 4 [666a 15]). For example, Aristotle regarded the soul as the seat of life: When the soul departs, the body dies (*On the Soul*, book 1, chap. 5 [411b 8]). He therefore concluded that the soul is located in the heart (e.g., *On the Motion of Animals*, chap. 10 [703a 12–15, 38]; *On the Parts of Animals*, book 2, chap. 1 [647a 25–30]; *On Youth and Old Age, on Life and Death, on Breathing*, chap. 3 [469a 10–22]). The heart is the first organ to be formed in the embryo and the first to begin functioning (*On the Parts of Animals*, book 3, chap. 4 [666a 14–22]); when life fails, it is the last organ to fail (*On the Generation of Animals*, book 2, chap. 5 [741b 19–20]); and it is centrally located within the body.

Leibniz's philosophy is idealistic rather than mechanistic (Kantor, 1969, pp.

62–63, 137). In agreement with the idealist theologians, he believed that God created and runs the universe (Mates, 1986, chap. 2).

Hegel's philosophy is also not mechanistic; it is the paradigm case of dialectical idealism, or organicism as defined by Pepper (1942; for brief description, see Hayes, Hayes, & Reese, 1988). In Hegel's philosophy, absolute truth is both the cause and the end of development, and development is always progressive because it is guided by this end.

Purpose as beginning and end. In grand-design teleologies, including mechanistic and idealistic theologies and philosophies, purpose is the beginning as well as the end. God's grand design or God's word is the first cause as well as the end; Aristotle's nature and Hegel's absolute truth are both the beginning and the end. In this sense, the end is antecedent to change; but even in the beginning, it functions as a final cause, not as an efficient cause. In modern psychology, this kind of teleology is exemplified by Piaget's theory, in which the mature form of thinking—formal operational thinking—is the end that explains the directionality of the development of thinking; that is, this end explains why the child goes through *these* stages in *this* sequence.

Reactions to grand-design teleologies. As Imam (1989) pointed out, behavior analysts consistently and correctly reject any kind of grand-design teleology. Furthermore, I know of no modern scientific mechanists who treat the maker of the machine as part of the positive analogy of the mechanistic worldview, and therefore the issue of grand-design teleology does not arise within modern mechanism. Moxley (1991) implicitly made the same point in denying that this kind of teleology even exists.

The instinct psychologist William McDougall (1930) also rejected the grand-design kind of teleology, opting instead for an "internal" teleology in which purpose is in the organism rather than in nature. Specifically, McDougall said that purpose is a mental phenomenon and that it contradicts "strictly mechanical or Newtonian explanation" (p. 7). Howev-

er, the latter point can be accepted without acceptance of any implication that purpose is mental (Moxley, 1991).

Ontological and Epistemological Teleology

Although grand-design teleologies are rejected in behavior analysis and all other sciences, teleology has other meanings that need to be analyzed. The analysis is furthered by distinguishing between ontological and epistemological concepts of teleology. Ontology refers to the nature of existence, and epistemology refers to the nature of knowledge; the basic questions are, respectively, "What exists?" and "How do we know?" Ontological teleology, which is the classical version, refers to purpose in nature; epistemological teleology refers to a kind of "as if" explanation, which is discussed in a later subsection (Constitutive and Regulative Teleology).

The time-reversal problem. As already noted, classical teleology requires reversal of time such that the future determines the present. Actually, time reversal is one of the defining characteristics of teleology, not only in classical discussions but also in modern discussions (e.g., in Alessi, 1992, p. 1360; Palmer & Donahoe, 1992, p. 1356). In the epistemological domain, time reversal can be conceptualized as an "as if" rule (a "regulative" rule, as discussed later); therefore, time reversal is not a problem for epistemological teleology. However, classical teleology (i.e., ontological teleology) is possible only in an ontology in which time reversal is possible.

In modern mechanistic ontologies, in which the maker of the machine is negative analogy, time is unidirectional and, consequently, the required reversal is impossible in these ontologies; that is, it is impossible in the real world as understood in these ontologies. Classical teleology is therefore inconsistent with modern mechanistic ontologies (Feigl, 1950; Hempel & Oppenheim, 1948; Russell, 1929/1953; Schlick, 1925/1953). This point needs further development. Contrary to the point just made, Grünbaum

(1967) argued that time has no direction in the real world, and Marr (1993) and Overton (1993) said that the Newtonian machine had no arrow of time. Marr added, "Newton's world run backwards would look the same as it does going forwards, a perfect temporal symmetry" (p. 63). However, Newton's world is not symmetrical backward and forward. Run forward, hail falls from the sky toward the earth; run backward, hail rises from the earth toward the sky. Run backward, gravity would be mutual repulsion rather than mutual attraction.

In reality (ontology), neither Newton's world nor any other world can run backward, even though the preceding discussion shows that it can be thought of as running backward. However, the thought of the world running backward is in the domain of knowledge (epistemology), and although in this domain explanation and prediction are symmetrical (and this is the entire meaning of the symmetry attributed to the Newtonian machine), time also possesses an arrow in this domain, because explanation refers to the past by giving time a negative value in the equations representing known laws, and prediction refers to the future by giving time a positive value in these equations.

Solutions of the time-reversal problem. The problem of classical (ontological) teleology—the reversal of unidirectional time—has been solved in many ways, most of which have one feature in common: They reconceptualize the "future" as a purpose that is antecedent to the present. If the purpose of a present event somehow precedes the present event, then the time-reversal problem disappears, because the "teleology" is no longer teleological in the classical sense of this word. That is, the time-reversal problem in teleology has usually been solved by rejecting teleology. Hempel and Oppenheim (1948) and Schlick (1925/1953) may seem to have contradicted this assertion in saying that when teleology is "correctly" interpreted, it is consistent with mechanism, but the "correct interpretation" they (and Moxley, 1991) referred to was in terms of antecedent conditions and general regularities. Thus, their "cor-

rect interpretation" makes teleology consistent with mechanism by making teleology nonteleological.

The cited "correct interpretation" requires rewording of teleological statements. Nagel (1979) gave as an example, "A robin is hunting for worms in order to feed its fledglings," which is a teleological statement, and "The robin's behavior is goal directed with respect to the goal of feeding its young," which is not teleological if "goal directed" and "goal" are interpreted as properties of a system (p. 290). Mayr (1976) objected to the systems approach on the argument that "goal directed" implies movement and "system" implies stasis, but his concept of "system" is too narrow. In a general systems approach to developmental psychology, for example, a system not only moves, it develops (e.g., Sameroff, 1989).

Constitutive and Regulative Teleology

Moxley (1991) said that nobody took the undesirable time-reversal implication of teleology seriously; but if so, I marvel at how much effort has been expended in attempts to save the concept of teleology from this implication—this "albatross around the neck of teleology" (Wright, 1976, p. 10). Teleology has been a powerfully useful concept for developmental psychologists, especially those who lean toward Hegel, and yet they also take pains to explain away the implication of temporally backward causation (e.g., Murray, 1991; Overton, 1991a, 1991b).

Developmental psychologists whose work is consistent with organicism (in Pepper's, 1942, sense; i.e., those who lean toward Hegel) explain away the implication by making teleology a regulative principle, as it was for Kant (1790/1952, sect. 66), rather than making it a constitutive principle, as it was for the theologians and for Hegel (it seems to have been both for Bergson, 1911, chap. 1, especially pp. 51ff and 87ff). A constitutive principle states a cause that is a productive force assumed to have ontological existence. A regulative principle

states a way to understand information; it is an epistemological principle. Constitutive teleology is rejected even in theories based on organicism, but regulative teleology is accepted: Murray (1991) said that time is unidimensional and that a later event therefore cannot be a constitutive cause of earlier events, but that taking into account a later event "can help us make sense of the earlier events by showing what the earlier events lead to" (p. 43). Nagel (1979) dismissed regulative teleology, but improperly because of its scientific status in organismic approaches.

Behavior analysts might accept regulative teleology: Behavior would be understood not by showing what consequences it has led to in the past, but by showing what consequences it leads to in the present. However, this kind of teleology generates "as if" reasons, as does Allport's teleonomy (as shown later); it does not generate functional explanations of the kind sought in behavior analysis. Thus, behavior analysts should not want any kind of teleology.

Necessity and Tendency in Teleological Explanations

Constitutive and regulative teleologies, discussed in the preceding subsection, are sometimes designated, respectively, as hard and soft teleologies. Each kind can also be designated as hard or soft in another sense, referring to necessity or tendency with respect to the event that is to be explained teleologically.

Necessity of the event. According to Taylor (1964, pp. 5–6), teleological explanation means that the occurrence of an event is explained by showing that the occurrence of the event is required to attain a specified goal. That is, according to this kind of teleological explanation, an event's being required to attain a specified goal is a *sufficient* condition for the event's occurrence. Thus, the behavior to be explained is said to have occurred because it was the only way to reach the goal.

Tendency of the event. In contrast to teleological explanations based on as-

sumed necessity, most teleological explanations are hedged, often by inserting the word *normally*, to allow for variability in the system. For example, a teleological explanation in psychology would state that a specified behavior occurred because the conditions of the organism and the environment were such that this behavior would *normally* yield attainment of the goal (Taylor, 1964, pp. 9–10).

Hempel (1967) stated a form of teleological explanation that was hedged even more drastically, by the substitution of *appropriate* for *required* or *normal*. Thus, the behavior to be explained is said to have occurred because it was a way (rather than the only way or the normal way) to reach the goal. Another hedge is needed for this kind of teleological explanation because, as Hempel noted, it requires asserting that the agent of the behavior is the kind of agent that will *generally* perform the appropriate action.

Wright (1976) also drastically hedged teleological explanation. Like Hempel, he rejected the necessity assumption in favor of identifying conditions that *tend* to bring about reaching the goal. Wright (p. 101) gave as an example:

(a) Some plants survive because photosynthesis takes place within them. (b) Chlorophyll is one source of photosynthesis. (c) Therefore: Some plants contain chlorophyll.

In other words, chlorophyll's having a particular function (photosynthesis) is the cause of the presence of chlorophyll in (some) plants. One objection to this example is that the logic is invalid (other objections were presented by Nagel, 1979). The logic is invalid because it exhibits the fallacy of the undistributed middle term. This fallacy reflects violation of the logical rule that in syllogistic reasoning, the middle term must be distributed at least once; that is, at least one of the premises must contain or imply the distributed qualifier "all" (Werkmeister, 1948, chap. 11). "Some" indicates that the middle term ("photosynthesis" in the example) is not distributed—may not be applicable—to all instances of the subject ("plants") or the predicate ("chlorophyll") of the conclusion, but in the fallacy the middle term is mistakenly taken

to be distributed to all instances of at least one of these terms. Rewording the premises may more clearly show that Wright's syllogism exhibits this fallacy:

(a) Minor premise: Some plants exhibit photosynthesis. (b) Major premise: Some photosynthesis involves chlorophyll. (c) Conclusion: Some plants contain chlorophyll.

The fallacy is revealed by noting that all of the "some plants" that exhibit photosynthesis may exhibit the kinds of photosynthesis that do not involve chlorophyll.

Wright said that an explanation is teleological if it refers to aims, drives, functions, goals, intentions, motives, needs, or purposes, but he said that referring to such concepts does not reverse the accepted antecedence of causes to effects (p. 10). Given that premise, which as Wright said is consistent with mechanism and which can be interpreted to mean that teleological explanation is not teleological, why did he write the rest of his 151-page book on teleological explanations?

Relevance to behavior analysis. In Wright's (1976) teleology, System S exhibits Behavior B because Behavior B tends to result in Goal G. He referred to this view as based on consequence-etiology, but he explicitly rejected the behavior-analytic principle that S exhibits B because B has led to G in the past, either in the history of the species or in the history of S (pp. 89–90).

Wright seems to have confused several meanings of function, which are different in reference to, for example, behaviors (e.g., one might say, "Falcons soar to conserve energy for long flights"), parts or organs ("Falcons have lightweight bones in order to fly"), faculties ("Falcons have keen vision so they can detect prey from great heights"), and processes ("The developmental sequence from egg through nestling and fledgling, etc., is the only way to arrive at the mature falcon-form"). Behavior analysis deals with behaviors, not with parts or organs and their functions or faculties, and not with processes in the above sense except in a speculative way (e.g., Skinner's comments about the natural selection of conditionability).

In the following quotation, Wright confused the function of a tool with the function of a behavior:

On Skinner's grounds we might be urged to say, for example, the dimmer switch [in an automobile] is there not because it allows us to adjust the headlights, but rather because in the past it and/or others were effective in adjusting the headlights. (p. 90)

Wright used the phrase "is there" to mean "has that form and location" (p. 77), and the clause Wright said Skinner would reject—the dimmer switch has that form and location because it allows us to adjust the headlights—is the one Wright advocated.

Actually, Skinner and other behavior analysts are less interested in explaining why the dimmer switch has its particular form and location than in explaining why it is pressed. In terms of a more common example from behavior analysis, the interest is less in explaining why the lever is in the box than in explaining why the rat presses it. For the latter interest, the lever is there because its being there allows researchers to observe changes in the behavior of the rat, not because it allows the rat to get food. Furthermore, the rat presses the lever not because its being there allows researchers to observe changes in the behavior of the rat, nor even because its being there allows the rat to get food. Rather, precisely as behavior analysts say, the rat presses the lever because in the past, pressing it was followed by access to food. Just so with the dimmer switch: On behavior analysts' grounds, we press it not because pressing it allows us to adjust the headlights but because in the past, pressing it and/or others like it was followed by adjustment of the headlights.

A final point here is that although behavior analysts are more interested in explaining why the rat presses the lever than in explaining why the lever is in the box, the explanation is fundamentally the same for the lever-pressing behavior of the rat and the apparatus-building behavior of behavior analysts: The lever is there not because its being there allows researchers to observe changes in the behavior of the rat but because in the past, its being there

was followed by observing changes in the behavior of the rat.

History in "Teleological" Explanations

The foregoing interpretation of teleology in terms of the history of the organism's interactions with its environment is entirely consistent with an earlier interpretation by Bunge (1959):

[Behaviors] are actually determined by the immediately previous states and by the whole past history of the organism, as well as by its environment; organs, functions, and behaviors could not be determined by future, still nonexistent needs; they are presumably determined by past and present conditions and are *adapted* beforehand to coming conditions, though not with foresight or conscious planning, but as a result of a long and blind past history of successes and failures. (p. 302)

Actually, Wright (1976) allowed this kind of history a role: An "action," but not a "reflex," is goal directed, done for the sake of an end (p. 127). However, an action can be performed automatically, as in pushing on the brake to stop an automobile in an emergency, or ducking punches in a fight. Nevertheless, according to Wright, even an automatic action is teleological because it reflects training or maintaining that was deliberate and goal directed, and consequently it reflects deliberate control. Thus, in his view, the control of an automatic action is not an immediately antecedent intention; rather, an automatic action is controlled intentionally "only over the long haul" (p. 128). Wright said:

It seems best to conclude that the adverbial and nominal forms of "intend" are related in a very complicated and tenuous fashion here: we can do something intentionally without there ever having been an intention to do it. Certainly this is preferable to the position that some nebulous something bearing so little resemblance to our normal intentions comes mysteriously into existence to accompany the startled movements and sanctify them as [goal-directed] action. (p. 129)

Yes, but the behavior-analytic position is even more preferable, because it avoids the very complicated, tenuous, and nebulous something that purportedly relates "intentionally" and "intention" and that purportedly results in intentional unintended behavior. The behavior-analytic

position is that an action can be goal directed only in the sense that it has been followed by attaining the specified goal in the past: This action occurs because it has been followed by attaining this goal in the past in the presence of the current setting conditions. Rule-governed behavior may seem to be an exception, but ultimately it also requires such a history.

According to the behavior-analytic position, the referents of "intentionally" and "intention" are not in nature, not in the environment, and not in the behavior. They are not necessarily even in the organism, contrary to Woodfield (1976, pp. 213–214), who said that such a history cannot be effective unless it leaves a trace. Rather, the referents are in the history of the organism. The issue of traces and histories is discussed further below (A Teleological Blur in Selection by Consequences).

Teleology—Conclusion

Teleology in the classical sense is not useful for behavior analysis and should be rejected.

TELEONOMY

The term *teleonomy* seems to have been introduced independently by Allport (1937), Pittendrigh (1958), and Monod (1972), perhaps among others, but the intent was the same in all three of these views—to avoid the time-reversal problem of teleology. They were successful, but not in ways that are useful for behavior analysis, as shown in the present section.

Allport's Teleonomy

Allport's (1937) concept of teleonomy avoids teleology by making purpose a matter of appearance rather than reality. It involves describing a person's behavioral trends "in terms of the purpose or purposes which he seems to be trying to carry out" (p. 204), but with the proviso that the purpose referred to is not assumed to be necessarily conscious (p. 205) and is not interpreted as "an agent, mo-

tive, or force" behind the person's behavior (p. 205). In other words, Allport's teleonomy is a regulative kind of teleology, an "as if" concept: The behavior that occurred led to a goal, and this behavior would have occurred if attainment of the goal had been the purpose of the organism that performed the behavior. Put another way, the behavior in question was *purposive*, and a teleonomic trend is revealed by identifying the purpose it serves (Lipsitt & Vallance, 1955, p. 381), but the behavior is attributed *purposefulness* only in an "as if" way.

Allport's teleonomy makes the concept of purpose consistent with the mechanistic worldview by making it an entirely descriptive concept. One might therefore imagine that the usual reconstruction of the derivation of the term is incorrect: According to the usual reconstruction, *teleonomy* is derived from the Greek *telos*, "end," and *-nomos*, "arranging" or "systematizing" (e.g., *Grand Larousse de la langue française*, 1978). Perhaps a better derivation, given the "as if" character of the term, is from the Greek *telos* and *onoma*, "name," which would make teleonomy mean "purposeful in name only."

Pittendrigh's Teleonomy

Pittendrigh (1958) recommended the term *teleonomy* to biologists on the same kind of argument that Imam (1989) used for recommending it to behavior analysts. Pittendrigh and Imam were discussing apparent goal-directedness in, respectively, biological adaptation and selection by consequences. Pittendrigh said:

The biologist's long-standing confusion would be more fully removed if all end-directed systems were described by some other term [than "teleological"], like "teleonomic," in order to emphasize that the recognition and description of end-directedness does not carry a commitment to Aristotelian teleology as an efficient causal principle. (p. 394)

Pittendrigh's reference to Aristotelian teleology as an *efficient* causal principle might reflect misunderstanding of Aristotle's distinction between final and efficient causality, especially given that he

might also have misunderstood Aristotle's distinction between material and efficient causality—Pittendrigh referred to final causes as not “materially efficient” (p. 393). However, the context indicates that he used “efficient” to mean “antecedent” and “materially” to mean ontologically real. Moxley (1991) commented that for Aristotle, the final cause of an event was actually antecedent to the event; like Pittendrigh, Overton (1991b) has used “material” to mean ontologically real. Also, Mayr quoted from a letter written to him by Pittendrigh, dated February 26, 1970, in which Pittendrigh again commented that Aristotle's teleology involved end as an “efficient” cause; but in the letter, Pittendrigh put this adjective in quotation marks (Mayr, 1976, Footnote 1, pp. 391–392). The antecedence of Aristotle's final cause led Mayr (1976) to say that Pittendrigh's teleonomy is consistent with Aristotle's teleology, and led Moxley (1991) to say that Aristotle's teleology did not involve time reversal. However, Pittendrigh, Mayr, and Moxley evidently overlooked the grand-design aspect of Aristotle's teleology, mentioned earlier.

Pittendrigh said that teleonomy is *functional* when it refers to goal-directed behavior and *evolutionary* when it refers to the origin of this function, and in neither sense is it *causal* in the sense of an antecedent, productive cause (p. 396). Nevertheless, according to Pittendrigh, neither sense of teleonomy involves a telos; both reflect a history—that is, natural selection—that involved only antecedent, productive causes. Given that the relevant history is conjectured rather than observed, Pittendrigh's teleonomy is, like Allport's, a regulative principle, that is, a way to understand certain phenomena. Taking it to be an explanation would be a category-mistake (Ryle, 1949, chap. 1).

Monod's Teleonomy

Like Allport's teleonomy, Monod's (1972) is mechanistic and purposeful in name only, but unlike Allport's—and Pittendrigh's—Monod's has a constitutive basis. However, Monod came close,

at least, to making a category-mistake, which may be one reason his teleonomy is “profoundly ambiguous,” as Monod himself characterized it (p. 14). It is descriptive and yet “it implies the subjective idea of ‘project’” (p. 14). He said that the structure of the camera is the realization or actualization of the “project” of capturing images, and “we must also agree, obviously enough, that a similar project is accomplished with the emergence of the eye of a vertebrate” (p. 14). The purported similarity seems not at all obvious, unless the maker of the camera has an analogue responsible for the deliberate making of the vertebrate's eye. As a matter of fact, in Monod's argument, the purpose resides ultimately in the genes, specifically in DNA, which embody the “essential teleonomic project,” the “unique primary project, which is the preservation and multiplication of the species” (p. 14). However, one could grant them this project, or grant it to the organism as a whole (Alessi, 1992), and still deny that the making of the vertebrate's eye is in any way analogous to the making of a camera.

Relevant to the last point, Mayr (1982) also believed that “teleonomic activity” is determined by a genetic program, and therefore that its cause is antecedent to the activity. He commented that the layperson's question—“How can man, the porpoise, birds of paradise, or the honey bee have evolved through chance?” (p. 516)—reflects a misunderstanding of natural selection; but perhaps it more likely reflects a distrust of post hoc explanation. Like God, natural selection moves in mysterious ways in leading not only to the vertebrate eye but also to saber teeth, giant antlers, and other grotesqueries.

Purpose in Monod's teleonomy is not an end; it is a blueprint for the future. Thus, purpose for Monod is a telos in name only; it is a hypothetical antecedent to the present. Because it is hypothetical, it is mystical—or “occult” as it would have been called in Newton's era (e.g., Newton, 1729, p. 392)—and it is no less mystical or occult for being given metaphorical residence in DNA than is the classical finalistic telos.

These considerations imply another source of ambiguity in Monod's teleonomy: He did not explain how the hypothesized program directs development. Mayr (1976) commented that if a philosopher asks a biologist for such an explanation, "Alas, all the biologist can tell him is that the study of the operation of programs is the most difficult area of biology" (p. 395). Thus, Monod's teleonomy avoids the time-reversal problem of teleology by substituting a mysterious antecedent "program" for a mysterious consequent "telos." The mystery is not resolved by referring to natural selection, which in this case is equally mysterious.

Teleonomy—Conclusion

Imam (1989) recommended that behavior analysts use the term *teleonomy* to refer to the effects of reinforcement. However, if *teleonomy* is interpreted as merely regulative, this recommendation seems inappropriate. Imam pointed out that some commentators interpret the three-term contingency as teleological, because the third term is the reinforcing stimulus and it occurs *after* the response (the middle term in the contingency) and as a *consequence* of the response. Imam was correct in saying that the use of "teleonomic" would avoid the negative implications of "teleological," but otherwise the term seems inappropriate either because it is a regulative rather than a constitutive principle (Allport, Pittendrigh) or because it has a genetic basis (Monod, Mayr). Moxley (1991) noted other problems with the concept. The issue Imam raised is addressed below (in *A Teleological Blur in Selection by Consequences*).

TELEOLOGY AND BEHAVIOR ANALYSIS

The Meaning of Selection by Consequences

Skinner (1984) said that selection by consequences is a "fact," and Chiesa (1992) agreed, but I agree with Delprato and Midgley (1992) that it is more appropriately called a "principle." Be that

as it may, the point to be made here is that behavior is not literally and directly selected or controlled by its consequences. Many—perhaps all—behavior analysts have said at least once that behavior is selected or controlled by its consequences. For example, Catania made this statement (1992, p. 249), and Skinner (1981) said, "Through operant conditioning, new responses could be strengthened ('reinforced') by events which immediately follow them" (p. 501).

However, such statements are merely shorthand ways of saying that behavior is selected (i.e., controlled) by its *history* of consequences, as I commented in a 1986 paper (p. 171), citing Skinner (1974, pp. 56–57). Skinner also said, "The experimental analysis of behavior goes directly to the antecedent causes in the environment" (1974, p. 30); "contingencies of selection necessarily lie in the past; they are not acting when their effect is observed" (1981, p. 503); and, more fully:

It is not correct to say that operant reinforcement "strengthens the response which precedes it." The response has already occurred and cannot be changed. What is changed is the future probability of responses in the same *class*. There is, therefore, no violation of the fundamental principle of science which rules out "final causes." . . . Instead of saying that a man behaves because of the consequences which *are* to follow his behavior, we simply say that he behaves because of the consequences which *have* followed similar behavior in the past. (Skinner, 1953, p. 87; his italics)

Thus, the full statement of the behavior analyst's position has no hint of teleology (except one discussed in the next subsection). The shorthand version sounds teleological, in that the consequence of a behavior that is ongoing right now is in the future; but the shorthand version is misleading and harmful only if it is carelessly taken to be the full, correct version.

A Teleological Blur in Selection by Consequences

The blur. As mentioned parenthetically in the preceding paragraph, the fact (or principle) of selection by consequences contains a hint of teleology. The hint of teleology occurs because only specific responses can be reinforced or punished,

according to Skinner (1969, p. 131), and because the occurrence of a reinforcer or punisher is a *future* event with respect to a specific response. Therefore, the effect of the reinforcer or punisher implies teleology. This problem led Imam (1989) to recommend the concept of teleonomy to behavior analysts and led Moxley (1991) to recommend a kind of teleology.

The issue. The problem is that a three-term contingency is learned even though the discriminative stimulus and the specific response are in the present and the reinforcer or punisher is in the future. The issue is whether this apparent effect of the future on the present can be explained without classical teleology. The issue is not resolved by expressing the time relation in the other possible way—the three-term contingency is learned even though the discriminative stimulus and the specific response are in the past when the consequent stimulus occurs—because the relation between the specific response and the consequent stimulus still involves futurity. How does the consequent stimulus get linked to *that* discriminative stimulus and *that* response?

The issue is also not resolved by referring to “responses of the same class” or to “similar behavior,” as in the statement by Skinner quoted above. In this resolution, reinforcement affects a *class* of responses (e.g., Moore, 1992b), contrary to Skinner’s (1969, p. 131) position that reinforcement affects only specific responses. The responses of interest in behavior analysis are *acts* rather than *movements*, in Guthrie’s senses (1960; Moxley, 1992; Skinner, 1953, p. 65), and a given act can be instantiated (performed) in many different ways. Nevertheless, each specific instance of a given response-as-act is unique, and the consequence that *follows* it is what affects later occurrences of “responses of the same class” and “similar behavior.” Skinner’s statement quoted above is relevant to, and solves, the problem of how a unique specific response can have a history, but it is not relevant to the issue under consideration: How does a future stimulus become associated with a present stimulus and response? (For discussion of Skinner’s concept of *class*, see

Delprato & Midgley, 1992; Glenn, Ellis, & Greenspoon, 1992. Note that the mechanistic behaviorists also defined responses as acts—e.g., Estes, 1950; Spence, 1956, pp. 42–43; Watson, 1924, pp. 11–13.)

Resolutions of the issue. One possible resolution of the issue, which seems to be accepted by many behavior analysts, is that the discriminative stimulus and the unique specific response leave traces in the organism, and the reinforcing or punishing stimulus occurs simultaneously with these traces. This resolution is consistent with Woodfield’s (1976, pp. 213–214) belief, noted earlier, that history cannot be effective unless it leaves a trace. The resolution eliminates the backward effect of consequences and therefore eliminates the hint of teleology. The traces might be physiological (e.g., Moore, 1992a), which would be consistent with a mechanistic account, or they might be mental representations (“information”), which would be consistent with a cognitive account (but see Marr, 1983, for a criticism of the latter kind of trace).

Another possible resolution, which is accepted by many behavior analysts and is consistent with contextualism, is that the issue is irrelevant because it cannot be resolved in any way that matters in practice: The history involving *that* stimulus, *that* response, and *that* consequence happened, and the behavior changed. What’s to explain? Prediction involves knowing the history of the organism, and control involves giving the history, and no explanation involving hypothetical traces of the history has led to improved prediction and control. How much of the history needs to be known? As much as is needed for effective prediction and control or, as Moore (1984) said, effective action.

In short, selection by consequences is a nonteleological explanation (Palmer & Donahoe, 1992) and the goals of behavior analysis—the prediction and control of behavior—do not profitably involve any kind of teleology.

Traces and histories. The resolution based on traces has sometimes been interpreted as reflecting the mechanistic denial of the possibility of action over a

physical or temporal distance and as evidence that behavior analysis is not mechanistic (e.g., Chiesa, 1992; Moxley, 1992). However, this denial was a principle in Cartesian mechanism. Newton did not deny action over a distance, at least with respect to gravity, and his famous statement, "Hypotheses non fingo" ("I do not feign hypotheses"), was a refusal to propose any untestable hypothesis about how this force is mediated (Latin: Newton, 1713, p. 484; English: Koyré, 1965, p. 35). Thus, the insistence by many behavior analysts that reference to history is sufficient is consistent with at least this principle of Newtonian mechanism.

PURPOSE AND BEHAVIOR ANALYSIS

Aristotle's Concept of Purpose

In behavior analysis, purpose has no relation of any kind to the concept of *telos*, which is the basis of both *teleology* and *teleonomy*. In classical teleology, including Aristotle's teleology, *telos*, or final cause, is the ultimate end that gives meaning to or explains present events or behaviors. Aristotle referred to final cause as "that for the sake of which a thing is done." For example,

[One speaks of cause] in the sense of end or "that for the sake of which" a thing is done, e.g., health is the cause of walking about. ("Why is he walking about?" we say. "To be healthy," and, having said that, we think we have assigned the cause.) (*Physics*, book 2, chap. 3 [194b 32]; 1952, p. 271)

The "thing" in the phrase "a thing is done" is not a product or form; it is the action specified in the efficient cause. For example, a sculptor's working of a block of marble is such a "thing."

"That for the sake of which" is general, and in any application the "that" needs to be specified, as in the phrase "for the sake of argument," or "for the sake of possessing a sculpture," or "in order to possess a sculpture." Another example, according to Aristotle, is the final cause of the senses of smelling, hearing, and seeing in animals; the final cause of these

senses is the "antecedent perception" required for pursuing prey and for avoiding predators. Examples in humans are these ends and (the pursuit of) truth (Aristotle, *On Sense and the Sensible*, chap. 1 [436b 17–437a 3]). In other words, the final cause specifies a form that is expected to result from the action specified in the efficient cause. However, the emphasis in final cause is not on an action such as arguing or possessing, but on the "that" in "that for the sake of which." This "that" is form, specifically, *potential* form (as distinguished from actual or actualized form, which is the referent of formal cause in Aristotle's taxonomy).

This kind of teleology does not require a grand design (Moxley, 1991), although as noted earlier, Aristotle gave nature a grand design. Nevertheless, it is a kind of teleology that Skinner rejected in excluding such statements as "A rat 'uses a lever to obtain food'" and "The pigeon was reinforced *for* pecking the key" (1963, p. 505; Skinner's italics). If I understand Rachlin's (1992) "teleological behaviorism," it is consistent with this view. Rachlin's explanation of probability—history of experiences with outcomes—seems consistent with behavior analysis, and although he extended behavior analysis into the cognitive domain, I do not see any evidence of teleology in his approach.

Purpose in Operant Behavior

The "that" in Aristotle's phrase "that for the sake of which a thing is done" is the end, such as health, and "a thing is done" means "an action is performed," such as "a person walks." Thus, "a person walks for the sake of health" means that health gives meaning to the behavior of walking. The behavior-analytic concept of purpose is only superficially similar. Operant behavior is sometimes said to be controlled by purposes; for example, Skinner said that operant behavior is "by its nature . . . directed toward the future: a person acts *in order that* something will happen, and the order is temporal" (Skinner, 1974, p. 55; see also Bijou & Baer, 1978, p. 11). If the behavior

is truly directed by the future, these statements imply acceptance of final causality. However, final causality is not a useful concept in behavior analysis, as already shown; therefore, operant behavior is best conceptualized not as controlled by purposes or by its consequences, but rather as controlled (selected) by the history of its consequences.

Operant behavior is controlled immediately (proximally) by antecedent stimuli functioning as efficient causes as a result of a particular history of consequences. The "teleology" of operant behavior is merely a reference to this history (e.g., Boles, 1993). That is, the temporal order referred to by Skinner is not from the future to the present, as in classical teleology, nor even from the present to the future, but from the past to the present. An organism behaves in a particular way not because the behavior will lead to a particular end, but because the behavior has been followed by that end in the past (Skinner, 1974, p. 57). The future goal or *telos* does not explain the present behavior. Rather, the attainment of goals in the past explains the present behavior. The latter kind of behavior is *purposive* rather than *purposeful*, and its consequence is "a result, not an end" (Hobhouse, 1901, p. 127).

Philosophers have distinguished between *functions* and *effects*, and although they debate about the precise distinction, the consensus is that *function* involves goal-directedness and *effect* does not (e.g., Nagel, 1979). Thus, one might say (as Skinner implied) that operant learning has a function, namely, survival and reproduction; but given the considerations in the preceding paragraph, one should say that operant behavior has not a function but an effect, namely, the occurrence or nonoccurrence of some stimulus (a reinforcer or a punisher).

Given this distinction, behavior analysis would be appropriately characterized as *effectual* analysis rather than *functional* analysis. Of course, it will not and need not come to be so characterized, not only because *effectual* is so inelegant a nonce word, but also and more importantly because *functional* analysis is un-

derstood to mean analysis in terms of the effects of the behaviors (Catania, 1992, p. 376). Furthermore, *functional* has the desired sense in Bunge's (1973) analysis of teleonomy in biology: "The biological function of X is *what X does*, not the aim it serves" (p. 48; his italics). Thus, for example, saying that the function of the beating heart is to pump blood means only that the beating heart pumps blood, and analogously, saying that the function of the rat's lever pressing is to obtain food means only that the rat's lever pressing activates the pellet-delivery machine.

Purpose in the Law of Effect

What is gained by calling operant behavior teleological? One possibility is that behavior analysis is thereby more clearly distinguished from "methodological behaviorism" and other views that purportedly fail to acknowledge the revolutionary principle of selection by consequences. This purpose is not achieved, because neither the "methodological behaviorists" nor any other behaviorists denied the law of effect, which refers to selection by consequences. The stimulus-response learning theorists acknowledged the dependence of learning on the consequences of behaving. For example, Hull (1943) emphasized this dependence, which he called the law of reinforcement (e.g., p. 71); and even the stimulus-response contiguity theorist Guthrie acknowledged the dependence (e.g., Guthrie, 1960, p. 140; Hergenhahn, 1976, pp. 193-194). Of course, Hull and Guthrie could be challenged for their interpretations of the dependence, respectively, in terms of drive reduction and stimulus change, but that is a separate issue. The issue here is that the concept of selection by consequences is a version of the law of effect, and both Hull and Guthrie, as well as Skinner, endorsed versions of this law.

McDougall (1930) saw hints of teleology in the law of effect, but it is teleological only if it means that present behavior is selected or controlled by its effects, as in Moxley's (1991) version of the law and in versions in which the or-

ganism *seeks* goals or behaves *in order to* attain goals. Moxley's version of the law of effect is not the same as Skinner's, as already shown, and Skinner explicitly rejected "goal-seeker" versions of the law. Skinner said that a person is not an active agent (1957, chap. 12), the organism is not a "true originator or initiator of action" (1974, p. 225), behavior analysis "has no place for a person as an initiating agent" (1981, p. 504), and "so long as we cling to the view that a person is an initiating doer, actor, or causer of behavior, we shall probably continue to neglect the conditions which must be changed if we are to solve our problems" (1981, p. 504).

This position is also evident in the role accorded to the organism's purposes, beliefs, and other private events: Taking them into account does not aid the prediction and control of behavior (Skinner, 1974, pp. 164–166, 225, chap. 13), because behavior is inexorably pulled or pushed by the genetic endowments of the organism, the history of its interactions with the environment, and the current environmental conditions. The organism's purposes, beliefs, and other private events are as completely determined by these variables as are its other behaviors; therefore, they can have no unique causal role. To believe otherwise would be to reject Skinner's position summarized in the preceding paragraph.

CONCLUSIONS

Mayr (1982, pp. 48–51) identified four kinds of telic concepts:

1. "Cosmic teleology" is teleology in the classical sense. This sense is not useful in behavior analysis.

2. A "teleonomic activity" is determined by a genetic program, and therefore the cause is antecedent to the activity. Behaviors that are genetically determined reflect phylogenetic selection and are recognized in behavior analysis. However, behavior analysts seldom study such behaviors; they usually study operant behaviors, which reflect ontogenetic selection. Therefore, the concept of teleonomy is not generally useful in behavior analysis.

3. An "adapted system" serves a purpose, but its doing so can be explained on the basis of evolution by natural selection. An example is the heart, which is adapted for pumping blood. Such systems are recognized but are seldom studied by behavior analysts. Therefore, this telic concept is doubtfully useful for behavior analysis.

4. A "teleomatic process" functions in accordance with mechanical laws. For example, a falling body reaches its end point in the sense that it stops falling when it lands. Operant behaviors also function in accordance with mechanical laws, according to arguments presented elsewhere, but calling them "teleomatic processes" rather than "operant behaviors" would not be useful. (For discussion relevant to mechanism and behavior analysis, see, e.g., Baer, 1993; Carr, 1993; Delprato, 1993; Hayes et al., 1988; Lee, 1993; E. K. Morris, 1993; Moxley, 1991, 1992; Reese, 1993.)

Behavior analysts reject teleology in its classical sense; in behavior analysis, the purposes of behavior cannot be part of an explanation of the behavior because whether they are mentalisms or private events, they are themselves in need of explanation. If mentalisms are cited, they need explanation because they are "explanatory fictions" (Baum & Heath, 1992). If private events are cited, they also need explanation because although they are real (Baum & Heath, 1992), they must also have histories of consequences. That is, the explanation of the behavior must refer not to purposes but to the processes or events that explain purposes. Actually, once they have been explained, purposes can be used in explanations as shorthand symbols. However, this use can easily lead to reifying them, as cautioned against in the Buddhist saying cited by Pascual-Leone (1991).

Hull and Spence explained purposes as covert conditioned consummatory responses that, once conditioned, occur prior to the occurrence of the unconditioned stimulus (e.g., Spence, 1960, p. 96). Skinner attributed purposes to the organism's history of consequences—the history of the three-term contingency. Thus, for example, "The pigeon pecks

the red spot in order to obtain access to the grain hopper" is teleological and is reworded not merely in the nonteleological form, "The pigeon pecks the red spot and obtains access to the grain hopper," but in a nonteleological form that is empirically justified and explanatory: "The pigeon pecks the red spot because in the history of this pigeon, instances of this response class have been followed by access to the grain hopper."

Selection by consequences is interpreted as teleological by some behavior analysts, but it need not be and, given the disfavor of teleology in modern science, it should not be. Selection by consequences and some other principles in behavior analysis are teleological only in a peculiar sense of teleology, and when these principles are called teleological, readers and listeners may well misunderstand. I see no reason to tar behavior analysis in this needless way.

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